

Serial No. 10/801,152
May 10, 2005
Reply to the Office Action dated December 10, 2004
Page 8 of 15

REMARKS/ARGUMENTS

Claims 1, 10-16 and 19-23 are pending in this application. By this Amendment, Applicants amend claims 1, 10 and 16, cancel claims 2-9, 17 and 18, and add claims 21-23.

Applicants appreciate the Examiner's indication that claim 12 would be allowable if rewritten in independent form including all of the features of the base claim and any intervening claims.

Claims 1, 3-9 and 17-20 were rejected under 35 U.S.C. § 103(a) as being unpatentable over Mihara et al. (JP 6-208903). Claims 1, 3-9 and 16-20 were rejected under 35 U.S.C. § 102(e) as being anticipated by Iwao et al. (U.S. 6,556,123). Claims 2, 8, 9, 10, 11 and 13-15 rejected under 35 U.S.C. § 103(a) as being unpatentable over Iwao et al. or Mihara et al. in view of Kawachi (JP 3-208301). Applicants note that the Examiner has not listed claim 16 in the rejection over Mihara et al. However, since claim 16 is referred to in the description of the rejection over Mihara et al., Applicants assume that the Examiner intended to include claim 16 in the rejection over Mihara et al. Claims 2-9, 17 and 18 have been canceled. Applicants respectfully traverse the rejections of claims 1, 10, 11, 13-16, 19 and 20.

Claim 1 has been amended to recite:

“A positive temperature coefficient thermistor comprising:
a laminate including a plurality of thermistor layers stacked in a lamination direction and having a positive resistance temperature coefficient;
first and second external electrodes disposed at different positions on an outer surface of the laminate;
a plurality of first internal electrodes and a plurality of second internal electrodes arranged so as to extend along predetermined interfaces between the plurality of thermistor layers inside of the laminate and so as to be electrically connected to the first external electrode and the second external electrode, respectively, the first internal electrodes and the second internal electrodes being arranged alternately in the lamination direction so that a portion of the first internal electrodes and a

Serial No. 10/801,152

May 10, 2005

Reply to the Office Action dated December 10, 2004

Page 9 of 15

portion of the second internal electrodes overlap each other while sandwiching the thermistor layers therebetween; and
at least one non-heating portion, which is not heated when a voltage is applied between the first and second internal electrodes, being located at an approximate center along a direction that is substantially perpendicular to the lamination direction of the portion of the laminate where the first and the second internal electrodes are arranged and at least in an approximate center in the lamination direction thereof; wherein **the at least one non-heating portion includes a cavity provided in at least one of the thermistor layers; the cavity is disposed at least in the approximate center of the laminate in the lamination direction; and the cavity does not extend entirely through the laminate.**" (emphasis added)

Claim 10 has been amended to recite:

"A positive temperature coefficient thermistor comprising:
a laminate including a plurality of thermistor layers stacked in a lamination direction and having a positive resistance temperature coefficient;
first and second external electrodes disposed at different positions on an outer surface of the laminate;
a plurality of first internal electrodes and a plurality of second internal electrodes arranged to extend along predetermined interfaces between the plurality of thermistor layers inside of the laminate and so as to be electrically connected to the first external electrode and the second external electrode, respectively, the first internal electrodes and the second internal electrodes being arranged alternately in the lamination direction so that a portion of the first internal electrodes and a portion of the second internal electrodes overlap each other in the lamination direction while sandwiching the thermistor layers; and
at least one cavity being provided in at least one of the thermistor layers in an approximate center along a direction that is substantially perpendicular to the lamination direction of the portion of the laminate where the first and the second internal electrodes overlap each other, the at least one cavity being positioned at least at an approximate center in the longitudinal and width directions of the portion of the laminate where the first and second internal electrodes overlap each other, the at least one cavity being positioned at least at an approximate center in the lamination

Serial No. 10/801,152

May 10, 2005

Reply to the Office Action dated December 10, 2004

Page 10 of 15

direction of the portion of the laminate where the first and the second internal electrodes are arranged; wherein the at least one cavity does not extend entirely through the laminate." (emphasis added)

Claim 16 has been amended to recite:

"A positive temperature coefficient thermistor comprising:
a laminate including a plurality of thermistor layers stacked in a lamination direction and having a positive resistance temperature coefficient;

first and second external electrodes disposed at different positions on an outer surface of the laminate; and

a plurality of first internal electrodes and a plurality of second internal electrodes arranged so as to extend along predetermined interfaces between the plurality of thermistor layers inside the laminate and so as to be electrically connected to the first external electrode and the second external electrode, respectively, the first internal electrodes and the second internal electrodes being arranged alternately in the lamination direction so that a portion of the first internal electrodes and a portion of the second internal electrodes overlap each other while sandwiching the thermistor layers therebetween, at least one of the first and second internal electrodes which is positioned at least at an approximate center in the lamination direction of the portion of the laminate where the first and second internal electrodes are arranged including a portion thereof that is not provided with the electrode, the portion not provided with the electrode being positioned at least an approximate center along a direction that is substantially perpendicular to the lamination direction of the portion of the laminate where the first and second internal electrodes overlap each other; wherein

the portion not provided with the electrode includes an opening provided in the internal electrode;

the opening is positioned at least at an approximate center in the longitudinal and width directions of the portion of the laminate where the first and second internal electrodes overlap each other; and

the size of the opening is at least about 0.1 mm."
(emphasis added)

New claim 21 recites:

"A positive temperature coefficient thermistor comprising:

Serial No. 10/801,152

May 10, 2005

Reply to the Office Action dated December 10, 2004

Page 11 of 15

a laminate including a plurality of thermistor layers stacked in a lamination direction and having a positive resistance temperature coefficient;

first and second external electrodes disposed at different positions on an outer surface of the laminate; and

a plurality of first internal electrodes and a plurality of second internal electrodes arranged so as to extend along predetermined interfaces between the plurality of thermistor layers inside the laminate and so as to be electrically connected to the first external electrode and the second external electrode, respectively, the first internal electrodes and the second internal electrodes being arranged alternately in the lamination direction so that a portion of the first internal electrodes and a portion of the second internal electrodes overlap each other while sandwiching the thermistor layers therebetween, at least one of the first and second internal electrodes which is positioned at least at an approximate center in the lamination direction of the portion of the laminate where the first and second internal electrodes are arranged including a portion thereof that is not provided with the electrode, the portion not provided with the electrode being positioned at least an approximate center along a direction that is substantially perpendicular to the lamination direction of the portion of the laminate where the first and second internal electrodes overlap each other; wherein

the portion not provided with the electrode includes a cut portion provided in the internal electrode; and

the cut portion is positioned at least at an approximate center in the longitudinal and width directions of the portion of the laminate where the first and second internal electrodes overlap each other." (emphasis added)

With the unique combination and arrangement of elements recited in Applicants' claims 1, 10, 16 and 21, Applicants have been able to provide a laminate-type positive temperature coefficient thermistor having a greatly improved withstand voltage property without experiencing breakdowns in the laminate (see, for example, the first full paragraph on page 2 of the originally filed specification).

The Examiner alleged that each of Mihara et al. and Iwao et al. teaches each and every feature recited in Applicants' claims 1 and 16.

In addition, the Examiner acknowledged that Mihara et al. and Iwao et al. fail to

Serial No. 10/801,152

May 10, 2005

Reply to the Office Action dated December 10, 2004

Page 12 of 15

teach or suggest a cavity. However, the Examiner alleged that Kawachi teaches holes 1 extending all the way through a thermistor layer, and that Strumpler et al. teaches cavities 9. Thus, the Examiner concluded that it would have been obvious to modify the devices of Mihara et al. and Iwao et al. to include holes or cavities as allegedly taught Kawachi and Strumpler et al.

Claim 1 has been amended to recite the features of "the at least one non-heating portion includes a cavity provided in at least one of the thermistor layers," "the cavity is disposed at least in the approximate center of the laminate in the lamination direction" and "the cavity does not extend entirely through the laminate."

Claim 10 has been amended to recite the features of "at least one cavity being provided in at least one of the thermistor layers in an approximate center along a direction that is substantially perpendicular to the lamination direction of the portion of the laminate where the first and the second internal electrodes overlap each other, the at least one cavity being positioned at least at an approximate center in the longitudinal and width directions of the portion of the laminate where the first and second internal electrodes overlap each other, the at least one cavity being positioned at least at an approximate center in the lamination direction of the portion of the laminate where the first and the second internal electrodes are arranged" and "the at least one cavity does not extend entirely through the laminate."

Claim 16 has been amended to recite the features of "the portion not provided with the electrode includes an opening provided in the internal electrode" and "the opening is positioned at least at an approximate center in the longitudinal and width directions of the portion of the laminate where the first and second internal electrodes overlap each other" and "the size of the opening is at least about 0.1 mm."

New claim 21 recites the features of "the portion not provided with the electrode includes a cut portion provided in the internal electrode" and "the cut portion is positioned at least at an approximate center in the longitudinal and width directions of

Serial No. 10/801,152

May 10, 2005

Reply to the Office Action dated December 10, 2004

Page 13 of 15

the portion of the laminate where the first and second internal electrodes overlap each other."

With respect to claims 1 and 10, as acknowledged by the Examiner, neither Mihara et al. nor Iwao et al. teaches or suggests the feature of a cavity. The Examiner alleged that Kawachi teaches holes and that Strumpler et al. teach cavities. However, Kawachi and Strumpler et al. fail to teach or suggest any laminate including a plurality of thermistor layers or any specific locations of the holes or cavities within such a laminate. Thus, Kawachi and Strumpler et al. certainly fail to teach or suggest the features of "the at least one non-heating portion includes a cavity provided in at least one of the thermistor layers," "the cavity is disposed at least in the approximate center of the laminate in the lamination direction" and "the cavity does not extend entirely through the laminate" as recited in Applicants' claim 1, and the features of "at least one cavity being provided in at least one of the thermistor layers in an approximate center along a direction that is substantially perpendicular to the lamination direction of the portion of the laminate where the first and the second internal electrodes overlap each other, the at least one cavity being positioned at least at an approximate center in the longitudinal and width directions of the portion of the laminate where the first and second internal electrodes overlap each other, the at least one cavity being positioned at least at an approximate center in the lamination direction of the portion of the laminate where the first and the second internal electrodes are arranged" and "the at least one cavity does not extend entirely through the laminate" as recited in Applicants' claim 10.

Accordingly, Applicants respectfully submit that Mihara et al., Iwao et al., Kawachi and Strumpler et al., applied alone or in combination, fail to teach or suggest the unique combination and arrangement of elements recited in Applicants' claims 1 and 10.

With respect to claims 16 and 21, Mihara et al. teaches a plurality of openings 6 and cut portions 8 which are clearly disposed along edges of the electrodes 3 and away from the center of the laminate (see Figs. 2 and 3 of Mihara et al.). In addition, Mihara

Serial No. 10/801,152
May 10, 2005
Reply to the Office Action dated December 10, 2004
Page 14 of 15

et al. fails to teach or suggest any specific size of the openings. Similarly, Iwao et al. teaches an electrode having an opening 57 disposed at an end of the electrode, as seen in Fig. 15(a) and away from the center of the laminate. Iwao et al. fails to teach or suggest any specific size of the opening 57. Thus, Mihara et al. and Iwao et al. certainly fails to teach or suggest the features of "the portion not provided with the electrode includes an opening provided in the internal electrode" and "the opening is positioned at least at an approximate center in the longitudinal and width directions of the portion of the laminate where the first and second internal electrodes overlap each other" and "the size of the opening is at least about 0.1 mm" as recited in Applicants' claim 16, and the features of "the portion not provided with the electrode includes a cut portion provided in the internal electrode" and "the cut portion is positioned at least at an approximate center in the longitudinal and width directions of the portion of the laminate where the first and second internal electrodes overlap each other" as recited in Applicants' claim 21.

Neither Kawachi nor Strumpler et al. teaches or suggests any electrodes having openings or cut portions therein. Thus, Applicants respectfully submit that Kawachi and Strumpler et al. fail to cure the deficiencies of Mihara et al. and Iwao et al. described above.

Accordingly, Applicants respectfully submit that Mihara et al., Iwao et al., Kawachi and Strumpler et al., applied alone or in combination, fail to teach or suggest the unique combination and arrangement of elements recited in Applicants' claims 16 and 21.

In view of the foregoing amendments and remarks, Applicants respectfully submit that Claims 1, 10, 16 and 21 are allowable. Claims 11-15, 19, 20, 22 and 23 depend upon claims 10, 16 and 21, and are therefore allowable for at least the reasons that claims 10, 16 and 21 are allowable.

In view of the foregoing amendments and remarks, Applicants respectfully submit that this application is in condition for allowance. Favorable consideration and prompt

Serial No. 10/801,152
May 10, 2005
Reply to the Office Action dated December 10, 2004
Page 15 of 15

allowance are solicited.

To the extent necessary, Applicant petitions the Commissioner for a Two-month extension of time, extending to May 10, 2005, the period for response to the Office Action dated December 10, 2004.

The Commissioner is authorized to charge any shortage in fees due in connection with the filing of this paper, including extension of time fees, to Deposit Account No. 50-1353.

Respectfully submitted,

Date: May 10, 2005


Attorneys for Applicant

Joseph R. Keating
Registration No. 37,368

Christopher A. Bennett
Registration No. 46,710

KEATING & BENNETT LLP
10400 Eaton Place, Suite 312
Fairfax, VA 22030
Telephone: (703) 385-5200
Facsimile: (703) 385-5080